Wildlife and Highway Management

Lesson 2: How Do We Solve the Problem of Wildlife on Our Roads?

LESSON OVERVIEW

Students use actual scientific data to evaluate the movement of elk. Using this information, they must determine where to build three wildlife bridges or underpasses along the highway as well as develop several cost-saving alternatives. They will write a formal report to present their findings.

SUGGESTED GRADE LEVELS

7 − 12

ENDURING UNDERSTANDINGS

- Accurate and reliable data need to be analyzed impartially to develop conclusions.
- Technology has improved data collection for scientists.

OBJECTIVE

Students will:

- Analyze tables and graphs to come to a conclusion.
- Write a report in which their conclusions are supported by facts.

ARIZONA DEPARTMENT OF EDUCATION STANDARDS

Grade	Science	Mathematics	Writing
7	S1-C3-01; S1-C3-05;	S2-C1-03; S2-C1-04;	S2-C1-01; S2-C1-03;
	S1-C4-02; S1-C4-03;	S2-C1-05; S2-C1-07;	S2-C1-04; S2-C2-03;
/	S1-C4-05; S3-C1-03;	S2-C1-08; S2-C1-09	S2-C2-05; S2-C3-02;
	S3-C2-01; S3-C2-02		S2-C3-04; S2-C4-01;
	S1-C3-01; S1-C3-05;	S2-C1-03; S2-C1-07;	S2-C4-03; S2-C5-02;
8	S1-C4-01; S1-C4-02;	S2-C1-08	S3-C2-01; S3-C2-03
8	S1-C4-03; S1-C4-05;		
	S3-C2-01; S3-C2-02		
	S1-C1-01; S1-C4-01;	S2-C1-02; S2-C1-08;	S2-C1-03; S2-C1-05;
	S1-C4-02; S1-C4-03;	S2-C1-09; S2-C1-11	S2-C2-03; S2-C2-05;
High	S1-C4-04; S3-C1-01;		S2-C3-02; S2-C3-03;
School	S3-C1-03; S3-C1-04;		S2-C4-01; S2-C4-02;
	S3-C2-02; S3-C2-03;		S2-C4-03; S2-C5-03;
	S3-C2-05		S3-C2-01



TIME FRAME

• Two to three days (45 minutes each day)



MATERIALS

- How Do We Stop Wildlife-Vehicle Collisions worksheet (one per team)
- *Ecology* of *Elk* worksheet (one per team)
- Elk Movement Research worksheet (one per team)
- Research Rubric (one per team)
- Computers with Internet access (one per team) or copies of various Web sites for research

TEACHER PREPARATION

- Make copies of the *How Do We Stop Wildlife-Vehicle Collisions*, *Ecology of Elk*, and *Elk Movement Research* worksheets and the *Research Rubric* for each team. You might also want to make copies for each student.
- If computer access is not available, preview the Web sites and print out relevant information. You should find specific ways to prevent wildlifevehicle collisions. Make copies of these for students to use in class.

SUGGESTED PROCEDURES

- 1. Divide the class into teams and hand out the worksheets.
- 2. Read the first worksheet, *How Do We Stop Wildlife-Vehicle Collisions*, as a class and review the map of proposed sites.
- 3. Inform the teams that the remaining worksheets present data on elk ecology and elk movements across the highway. They must analyze the data to determine where to build the bridges or underpasses. They will then use the computers or the printed material to research alternatives to bridges and underpasses and determine if any will work best in this situation. Each team (or each student if you prefer) will then write a research report that explains their conclusions.
- 4. Be sure to allow sufficient time. This portion of the assignment may take more than one day.
- 5. When the teams have completed their analyses, assign the research report.

ASSESSMENT

Research report

EXTENSIONS

• Have students research the work done in Banff National Park along the Trans-Canada Highway and compare it to the plan for State Route 260 in Arizona.





Appendix A: Arizona Department of Education Standards - Full Text

Science Standards

Grade	Strand	Concept	Performance Objective
7	1	3 – Analysis and	1 – Analyze data obtained in a scientific
		Conclusions	investigation to identify trends
			5 – Formulate a conclusion based on
			data analysis
		4 – Communication	1 – Choose an appropriate graphic
			representation for collected data
			2 – Display data collected from a
			controlled investigation
			3 – Communicate the results of an
			investigation with appropriate use of
			qualitative and quantitative information
			5 – Communicate the results and
	2	1 01 :	conclusion of the investigation
	3	1 – Changes in	3 – Propose possible solutions to
		Environments	address the environmental risks in
		2 Caianaa and	biological or geological systems
		2 – Science and	1 – Propose viable methods of
		Technology in	responding to an identified need or problem
		Society	2 – Compare solutions to best address
			an identified need or problem
8	1	3 – Analysis and	1 – Analyze data obtained in a scientific
	1	Conclusions	investigation to identify trends
			5 – Explain how evidence supports the
			validity and reliability of a conclusion
		4 – Communication	1 – Communicate the results of an
			investigation
			2 – Choose an appropriate graphic
			representation for collected data
			3 – Present analyses and conclusions in
			clear, concise formats
			5 – Communicate the results and
			conclusions of the investigation
	3	2 – Science and	1 – Propose viable methods of
		Technology in	responding to an identified need or
		Society	problem
			2 – Compare solutions to best address
			an identified need or problem



Science Standards Continued

Science Standards Continued			
Grade	Strand	Concept	Performance Objective
High	1	1 – Observations,	1 – Evaluate scientific information for
School		Questions, and	relevance to a given problem
		Hypotheses	
		4 – Communication	1 – For a specific investigation, choose
			an appropriate method for
			communicating the results
			2 – Produce graphs that communicate
			data
			3 – Communicate results clearly and
			logically
			4 – Support conclusions with logical
			scientific arguments
	3	1 – Changes in	1 – Evaluate how the processes of
		Environment	natural ecosystems affect, and are
			affected by, humans
			3 – Assess how human activities can
			affect the potential for hazards
			4 – Evaluate how urban development
			affects the quality of the environment
		2 – Science and	2 – Recognize the importance of basing
		Technology in	arguments on a thorough understanding
		Society	of the core concepts and principles of
			science and technology
			3 – Support a position on a science or
			technology issue
			5 – Evaluate methods used to manage
			natural resources

Mathematics Standards

Grade	Strand	Concept	Performance Objective
7	2	1 – Data	3 – Determine when it is appropriate to use
		Analysis	histograms, line graphs, double bar graphs,
		(Statistics)	and stem-and-leaf plots
			4 – Interpret data displays including
			histograms, stem-and-leaf plots, circle
			graphs, and double line graphs
			5 – Answer questions based on data
			displays including histograms, stem-and-
			leaf plots, circle graphs, and double line
			graphs
			7 – Interpret trends from displayed data
			8 – Compare trends in data related to the
			same investigation
			9 – Solve contextual problems using
			histograms, line graphs or continuous data,
			double bar graphs, and stem-and-leaf plots



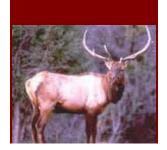
Mathematics Standards Continued

Grade	Strand	Concept	Performance Objective
8	2	1 – Data	3 – Determine the appropriate type of
		Analysis	graphical display for a given data set
		(Statistics)	7 – Formulate reasonable predictions based
			on a given set of data
			8 – Compare trends in data related to the
			same investigation
High	2	1 – Data	2 – Organize collected data into an
School		Analysis	appropriate graphical representation
		(Statistics)	8 – Make reasonable predictions for a set of
			data, based on patterns
			9 – Draw inferences from charts, tables,
			graphs, plots, or data sets
			11 – Evaluate the reasonableness of
			conclusions drawn from data analysis

Writing	Writing Standards		
Grade	Strand	Concept	Performance Objective
7 - 8	2	1 – Ideas and	1 – Use clear, focused ideas and details to
		Content	support the topic
			3 – Develop a sufficient explanation or
			exploration of the topic
			4 – Include ideas and details that show
			original perspective
		2 –	3 – Place details appropriately to support
		Organization	the main idea
			5 – Construct paragraphs by arranging
			sentences with an organizing principle (e.g.,
			to develop a topic, to indicate a chronology)
		3 – Voice	2 – Convey a sense of identity through
			originality, sincerity, liveliness, or humor
			appropriate to the topic and type of writing
			4 – Choose appropriate voice (e.g., formal,
			informal, academic discourse) for the
			audience and purpose
		4 – Word	1 – Use accurate, specific, powerful words
		Choice	that effectively convey the intended
			message
			3 – Use vocabulary that is original, varied,
			and natural
		5 – Sentence	2 – Create sentences that flow together and
		Fluency	sound natural when read aloud

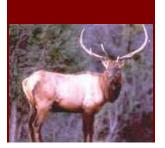


Writing Standards Continued			
Grade	Strand	Concept	Performance Objective
7 – 8	3	2 – Expository	1 – Record information (e.g., observations, notes, lists, charts, map labels and legends) related to the topic 3 – Write a process essay that includes: a. a thesis statement b. supporting details c. introductory, body, and concluding paragraphs
High School	2	1 – Ideas and Content	3 – Provide sufficient, relevant and carefully selected details for support 5 – Include ideas and details that show original perspective and insights
		2 – Organization	3 – Place details appropriately to support the main idea 5 – Employ a variety of paragraphing strategies (e.g., topical, chronological, spatial) appropriate to application and purpose
		3 – Voice	2 – Convey a sense of identity through originality, sincerity, liveliness, or humor appropriate to the topic and type of writing 3 – Choose appropriate voice (e.g., formal, informal, academic discourse) for the application
		4 – Word Choice	1 – Use accurate, specific, powerful words and phrases that effectively convey the intended message 2 – Use vocabulary that is original, varied, and natural 3 – Use words that evoke clear images
		5 – Sentence Fluency	3 – Demonstrate a flow that is natural and powerful when read aloud



Writing Standards Continued

Writing Standards Continued			
Grade	Strand	Concept	Performance Objective
High	3	2 – Expository	1 – Write a multi-paragraph essay that:
School			 a. includes background information to
			set up the thesis (hypothesis,
			essential question), as appropriate
			b. states a thesis with a narrow focus
			c. includes evidence in support of a
			thesis in the form of details, facts, examples, or reasons
			d. communicates information and ideas
			from primary and/or secondary
			sources accurately and coherently,
			as appropriate
			e. attributes sources of information as
			appropriate
			f. includes a topic sentence for each
			body paragraph
			g. includes relevant factors and
			variables that need to be considered
			h. Includes visual aids to organize and
			record information on charts, tables,
			maps, and graphs, as appropriate
			i. includes an effective conclusion



Appendix B: Worksheets and Overheads

The pages that follow contain the worksheets listed below:

- A. How Do We Stop Wildlife-Vehicle Collisions? A handout describing the activity (1 page)
- B. *Ecology of Elk* A brief summary of the history and ecology of elk in Arizona (1 page)
- C. *Elk Movement Research* A summary of the actual data collected on elk movement near State Route 260 (3 pages)
- D. Research Rubric One method to evaluate the student report (1 page)

